IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Application of:

Robert FISCHER et al.

Serial No. 10/564,832   Group Art Unit: 2611

Confirmation No. 5115

Filed: January 17, 2006   Examiner: Sarah Hassan

For: NONLINEAR PRECODING METHOD FOR A DIGITAL BROADCAST CHANNEL

APPEAL BRIEF UNDER 37 CFR §41.37

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Commissioner for Patents
PO Box 1450
Alexandria, VA 22313-1450

Sir:

In a Notice of Appeal filed September 21, 2009, the applicant appealed the Examiner's rejections of claims 4, 6, and 7 asserted in the Final Office Action mailed May 19, 2009 ("Final Office Action"), and with the requisite fee set forth in 37 CFR §41.20(b)(2).

The due date for filing of the Appellant's Brief is November 21, 2009. The Appellant's Brief with the requisite fee set forth in 37 CFR §1.17 is submitted herewith.

I. **REAL PARTY IN INTEREST**

The real party in interest is Siemens Aktiengesellschaft, the assignee of the subject application.

II. RELATED APPEALS AND INTERFERENCES

Appellant, Appellants' legal representatives, and assignee are not aware of any prior or pending appeals or interferences which directly affect or are directly affected by, or have a bearing, on the Board's decision in the pending appeal.

III. STATUS OF CLAIMS

Claims 4-8 are pending. Claims 1-3 are cancelled.

In the Final Office Action, the Examiner holds dependent claim 5 as being allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. (See, Final Office Action at page 4, lines 1-3).

Claims 4 and 6-7 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Yu et. al "Trellis Precoding for the Broadcast Channel" published in 2001, pages 1344-1348 ("Yu") in view of Yao et. al., "Lattice-Reduction-Aided Detectors for MIMO Communication Systems" published in 2002, pages 424-428 ("Yao") and are on appeal.

IV. STATUS OF AMENDMENTS

No amendment has been filed subsequent to the rejection made in the Final Office Action.

V. SUMMARY OF CLAIMED SUBJECT MATTER

Paragraph numbers refer to paragraph numbers of substitute specification filed January 17, 2006.

Claims 4 and 6-7 are appealed herein. The appealed independent claim is 4.

The claimed invention in independent claim 4 recites a nonlinear precoding method based on modulo arithmetic for the transmit-side preequalization of K user signals (see, for example, Fig. 3, K user signals ST_k and paragraph [0028]) to be transmitted concurrently using a frequency in a digital broadcast channel with known transmission behavior set up between a central transmitting station and K decentralized, non-interconnected receiving stations (see, for example, Fig. 1 and Fig. 3, signals SR_k received by decentralized receivers DR_k from central transmitter CT and paragraphs [0027]-[0028]).

The method of claim 4 includes the user signals consisting of data symbols a_k with k from 1 to K from a signal constellation having M_k levels and a signal point spacing A_k with a periodic multiple representation of the undisturbedly transmitted data symbols a_k (see, for example, Fig. 3 illustrating exemplary levels $M_k=2$, $A_k=1$ and k=1,...,K and paragraphs [0002] and [0028]) in data symbol intervals congruent for K receive-side modulo decision devices(see, for example, Fig. 3 and Fig. 4, data symbol a_k, and paragraphs [0002], [0028] and [0030]), a transmit-power-minimizing selection of representatives v_k from the range of values $a_k+A_k \cdot M_k \cdot z_{kk}$ where z_{kk} are integers (see, for example, Fig. 4, modulo operation MOD and paragraphs [0002] and [0030]) and linear preequalization of the selected representatives v_k to form transmit signals x_k to be transmitted (see, for example, Fig. 5 and paragraphs [0002] and [0033]).

The method of claim 4 includes interference symbols in the digital broadcast channel superimposed on the data symbols a_k and periodic multiple representation thereof due to cross-coupled user signals by an adapted periodic multiple representation (see, for example, Fig. 4, modulo operation MOD and paragraphs [0002] and [0030]), the interference symbols between the data symbol a_l with l from 1 to K and not equal to k and the data symbol a_k being assigned periodic representatives from a range of values $A_k \cdot M_k \cdot z_{lk}$ where z_{lk} are integers (see, for example, Fig. 3 and Fig. 4 and paragraphs [0002] and [0028]-[0030]).

The method of claim 4 includes eliminating the interference symbols by the K receive-side modulo decision devices. (See, for example, Fig. 4, permutation matrices P^T and P and cancelling each other out, and paragraphs [0031]-[0032]).

VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

The ground of rejection to be reviewed is whether claims 4 and 6-7 are properly rejected under 35 U.S.C. §103(a) as being unpatentable over Yu in view of Yao.

An issue is whether the Examiner erred in determining that a method including interference symbols in a broadcast and eliminating the interference symbols by receive-side devices would have been obvious to one having ordinary skill in the art at the time of the invention in view of the prior art.

Another issue is whether the Examiner erred in determining that a method including signals to be transmitted concurrently between a central transmitting station and decentralized, non-interconnected receiving stations would have been obvious to one having ordinary skill in the art at the time of the invention in view of the prior art.

Claims are each independently patentable over the reference as set forth below, and do not stand or fall together.

VII. ARGUMENT

a) Principles of Law

"Section 103 forbids issuance of a patent when 'the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains." *KSR Intl Co. v. Teleflex Inc.,* 127 S. Ct. 1727, 1734 (2007). The question of obviousness is resolved on the basis of underlying factual determinations including (1) the scope and content of the prior art, (2) any differences between the claimed subject matter and the prior art, (3) the level of skill in the art, and (4) where in evidence, so-called secondary considerations. *Graham v. John Deere Co.,* 383 U.S. 1, 17-18 (1966). *See also KSR,* 127 S. Ct. at 1734 ("While the sequence of these questions might be reordered in any particular case, the *[Graham]* factors continue to define the inquiry that controls.")

To establish obviousness under §103, the Examiner must consider the claimed invention "as a whole," and the prior art must teach or suggest all of the claim features. See Manual Of Patent Examining Procedure § 2143.03 (8th ed. Rev. 2 May 2004)("MPEP"); In re Royka, 180 U.S.P.Q. 580, 583 (C.C.P.A. 1974); In re Fine, 5 U.S.P.Q. 2d 1596, 1599 (Fed. Cir. 1988); Ruiz v. A.B. Chance Co., 69 U.S.P.Q.2d 1686, 1690 (Fed. Cir. 2004). If an independent claim is nonobvious under 35 .S.C. §103, then any claim depending therefrom is nonobvious. In re Fine, 837 F.2d 1071, 5 USPQ 2d 1596 (Fed. Cir. 1988). See Manual Of Patent Examining Procedure § 2143.03 (8th ed. Rev. 5 August 2006)("MPEP").

In KSR International Co. v. Teleflex Inc., 82 USPQ2d 1385, 127 SCt 1727, 167 LEd2d 705 (U.S. 2007), the U.S. Supreme Court held that in determining obviousness, one "must ask whether the improvement is more than the predictable use of prior art elements according to their established functions" slip op. 13, 82 USPQ2d at 1396. Furthermore, it is necessary "to determine whether there was an apparent reason to combine the known elements in the fashion claimed" slip op. 14, 82 USPQ2d at 1396.

The Supreme Court further affirmed In re Kahn, 441 F. 3d 977, 988 (CA Fed. 2006), stating: "[R]ejections on obviousness grounds cannot be sustained by mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness." In this regard, it is respectfully submitted that a single use/mention of a system/method by a single reference is insufficient evidence in the record that it would have been obvious to try the same in the primary reference. As relied upon

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in the KSR decision, any underlying obvious to try rationale still requires <u>evidence in the record</u> of the same.

Impermissible hindsight must be avoided and the legal conclusion must be reached on the basis of the facts gleaned from the prior art. See MPEP § 2142 Legal Concept of Prima Facie Obviousness. Hindsight cannot be used in determining the issue of obviousness and the reviewer must view the prior art without reading into that art the teachings of the application or patent (see <u>Kalman v. Kimberly Clark Corp.</u>713 F.2d 760,218 U.S.P.Q. 781(Fed. Cir. 1983)).

An assessment of basic knowledge and common sense that is not based on any evidence in the record lacks substantial evidence support. Id. at 1385, 59 USPQ 2d at 1697. See also In re Lee, 277 F.3d 1338, 1344-45, 61 USPQ 2d 1430, 1434-35 (Fed. Cir. 2002). (In reversing the Board's decision, the court stated "'common knowledge and common sense' on which the Board relied in rejecting Lee's application are not the specialized knowledge and expertise contemplated by the Administrative Procedure Act. Conclusory statements such as those here provided do not fulfill the agency's obligation... The board cannot rely on conclusory statements when dealing with particular combinations of prior art and specific claims, but must set forth the rationale on which it relies."). See MPEP § 2144.03.

As stated by the Supreme Court In re Kahn "[R]ejections on obviousness grounds cannot be sustained by mere conclusory statements."

*   *

b) Claim 4

First Examiner Error

The method of claim 4 recites " . . . <u>including interference</u> symbols in the digital <u>broadcast</u> channel superimposed on the data symbols and. . . <u>eliminating the interference</u> symbols <u>by</u> the K <u>receive-side</u> modulo decision devices." (Emphasis added).

That is, method 4 includes transmitting interference symbols and eliminating the interference symbols by the "receive-side" devices.

The Examiner concedes that Yu does <u>not</u> teach this feature. (See, Final Office Action, for example, at page 6, lines 15-16).

But, the Examiner relies on the disclosure of Yao in support of a combination with Yu since:

> Yao teaches a receiver that <u>detects a transmitted signal</u> and has <u>predetermined knowledge of the channel</u>, in order to eliminate "interference symbols."

(Emphasis, See, for example, Final Office Action at page 6, lines 18-20).

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The Examiner asserts it would have been obvious for one of ordinary skill in the art to combine Yu with teachings of Yao. (See, Final Office action at page 6, lines 21-22).

Appellant submits the Examiner errs in this assertion.

Appellant submits that Yu, in fact, teaches away from the asserted combination. For example, Yu teaches:

> Thus, an interference pre-subtracting scheme for each of the parallel sub-channels can be used to eliminate interference completely. . . .(see, for example page 1346, left col. second paragraph, lines 30-34) . . . This motivates us to find practical precoding methods to implement interference pre-subtraction. Since the pre- coding of vector channels can be implemented by precoding a series of scalar channels, the rest of the paper will concentrate on the precoding of a Gaussian scalar channel with non-causal side information. .(see, for example, page 1346, left col. line 42 - right col. line 3) . . . . The trellis precoder generalizes the Tomlison-Harashima precoder, and it is able to presubtract multiuser interference completely. By utilizing non-causal side information, the trellis precoder achieves an additional shaping gain up to 1.53dB. (See, page 1348, IV. Conclusion, liens 10-16).

(Emphasis added).

That is, Yu teaches away from a method eliminating interference at the receive side.

Appellants submit one having ordinary skill in the art would understand Yu as teaching that interference should be presubtracted before transmission.

In other words, one having ordinary skill in the art would understand Yu as teaching a method that should not be modified to eliminate interference at the receive side.

Thus, Appellant submits that the Examiner errs in relying on a combination of Yu and Yao to teach eliminating interference at a receive side, as recited by claim 4.

Thus, a *prima facie* case of obviousness is not supported and the rejection should be withdrawn.

*   *

Second Examiner Error

Independent claim 4 recites a method for ". . . user signals to be transmitted concurrently . . . between a central transmitting station and K decentralized, non-interconnected receiving stations . . . " (Emphasis added).

That is, claim 4 recites the decentralized, non-interconnected receiving stations receiving signals that are transmitted "concurrently" from a single, "central transmitting station."

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Appellant submits that the Examiner erred in asserting that Yu and Yao suggest to one of ordinary skill in the art a method that applies to a central transmitting station and decentralized receivers.

By contrast with claim 4, Yao merely teaches a method in which:

> [P]roofs and simulations in this paper are <u>limited to the 2 X 2 case</u>.

(See, for example, page 428, "VI. Summary And Future Work," last paragraph).

That is, Yao merely teaches a:

> [C]ase in which the channel matrix H is effectively known at the receiver but not at the transmitter.

(See, for example, page 424, "I. Introduction," third paragraph).

Thus, Appellant submits that one of ordinary skill in the art would not look at modifying teaching limited to a 2 x 2 case to a case, as recited by claim 4, that is not a 2 x 2 case.

<center>*   *</center>

The Examiner relies on Yu for teaching a method suggesting to one of ordinary skill in the art a method that applies to a central transmitting station and decentralized receivers.

In the final Office Action, the Examiner supports a combination by reliance on Yu's disclosure asserting:

> According to page 1344, Yu states "The downlink direction, where a single transmitter sends independent information to multiple receivers is often modeled as a broadcast channel."

(see, Final Office Action, for example, at page 3, lines 17-19).

But, Appellant submits that Yu teaches:

> The downlink direction, where a single transmitter sends independent information to multiple receivers is often modeled as a broadcast channel. The multiple access direction has been well-studied in recent years. The capacity region for the multiple access channel is well- known, and the capacity can be achieved using <u>a single- user code at each transmitter</u> and a multiuser joint detector at the receiver. The broadcast situation, on the other hand, is much less understood. This is mainly because the capacity region for the broadcast channel is still not known, except in the special degraded case. <u>This paper focuses on the broadcast problem</u>. <u>We will present two results for the non-degraded Gaussian vector broadcast channel with multiple antennas at the transmitter. First, we will show that an achievable rate region for the vector broadcast channel can be derived by decomposing the broadcast channel into a series of single-user channels with non-causal side information.</u> Secondly, we will show that a <u>practical trellis precoding method based on a generalization of Tomlinson-Harashima precoder can be used to approach the capacity</u> for channels with side information, thus approaching the broadcast rate region as well. These results will shed some light

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both on the computation of the achievable rate region for the broadcast channel, and on practical means to achieve it.

(Emphasis added, see, for example, page 1344, I. Introduction, left hand column).

That is, Yu focuses on presenting results using multiple antennas.

*   *

Appellant submits that one of ordinary skill would <u>not</u> modify Yao's teaching of a <u>multi-antenna</u> system with Yu's teaching of "<u>multiple</u> antennas at the transmitter," to teach all of the features recited by claim 4, for example.

Appellant submits that one having ordinary skill in the art would infer from Yu's disclosure a method using multiple antennas as <u>not</u> teaching a method using a central transmitter.

Thus, Appellant submits the Examiner erred in asserting a method between a central transmitting station and decentralized, non-interconnected receiving stations would have been obvious to one of ordinary skill in the art in view of Yao and Yu.

*   *

Appellant submits the evidence against obviousness outweighs the evidence for obviousness. *See In re Fenton,* 451 F.2d 640, 643 (CCPA 1971) (the court balanced the Patent Office's case against the strength of appellant's objective evidence of non-obviousness.)

Thus, the rejection of claim 4 should be withdrawn.

c) Dependent claim 6

Dependent claim 6 recites the method according to claim 5, "wherein offset compensation is already carried out on the transmit signals x_k prior to transmission."

But, the Examiner found the subject matter in intervening claim 5 allowable. (See, Final Office Action at page 4, lines 1-3).

Thus, the Examiner erred in the rejection of claim 6. Thus, the rejection should be withdrawn.

d) Dependent claim 7

Dependent claim 7 recites the method as claimed in claim 4 and "wherein offset compensation is already carried out on the transmit signals x_k prior to transmission."

As submitted in addressing the errors in rejecting claim 4, Appellant submits that the Examiner erred in showing a combination of Yu and Yao suggest to one of ordinary skill in the

teach a method between a central transmitting station and decentralized, non-interconnected receiving stations eliminating interference at a receive side.

Thus, the Examiner erred in the rejection of claim 7 and the rejection should be withdrawn.

Overall Summary

In view of the law and facts stated herein, Appellant respectfully submits that the Examiner has erred in establishing the obviousness rejection against the pending claims, the Examiner's findings of unpatentability should be reversed and the patentability over the presently cited references affirmed.

The Commissioner is hereby authorized to charge any additional fees required in connection with the filing of this Appeal Brief to our Deposit Account No. 19-3935.

Respectfully submitted,

STAAS & HALSEY LLP

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VIII: CLAIMS APPENDIX

1.- 3. (Cancelled).

4. A nonlinear precoding method based on modulo arithmetic for the transmit-side preequalization of K user signals to be transmitted concurrently using a frequency in a digital broadcast channel with known transmission behavior set up between a central transmitting station and K decentralized, non-interconnected receiving stations, the user signals consisting of data symbols a_k with k from 1 to K from a signal constellation having M_k levels and a signal point spacing A_k with a periodic multiple representation of the undisturbedly transmitted data symbols a_k in data symbol intervals congruent for K receive-side modulo decision devices, a transmit-power-minimizing selection of representatives v_k from the range of values $a_k + A_k \cdot M_k \cdot z_{kk}$ where z_{kk} are integers, and linear preequalization of the selected representatives v_k to form transmit signals x_k to be transmitted, comprising:

including interference symbols in the digital broadcast channel superimposed on the data symbols a_k and periodic multiple representation thereof due to cross-coupled user signals by an adapted periodic multiple representation, the interference symbols between the data symbol a_l with l from 1 to K and not equal to k and the data symbol a_k being assigned periodic representatives from a range of values $A_k \cdot M_k \cdot z_{lk}$ where z_{lk} are integers; and

eliminating the interference symbols by the K receive-side modulo decision devices.

5. A nonlinear precoding method according to claim 4, wherein mathematically required transmission behavior of the broadcast channel is achieved by factorization of the channel matrix **H**, describing current transmission behavior and known prior to transmission, into a reduced channel matrix $\mathbf{H_{red}}$ to be preequalized and a residual interference matrix **R**, where **H** = **R** $\mathbf{H_{red}}$, the residual interference matrix **R** assuming only 1 on the main diagonal and all other elements being row-wise integral multiples of the M_k levels of the signal constellation used and

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the reduced channel matrix H_{red} being obtained by factorization into a matrix F with orthogonal columns, a lower triangular matrix B and a permutation matrix P with the introduction of a receive-side scalar gain factor g according to $P^T H_{red} = 1/g \, B \, F^{-1}$.

6. A nonlinear precoding method according to claim 5, wherein offset compensation is already carried out on the transmit signals x_k prior to transmission.

7. A nonlinear precoding method according to claim 4, wherein offset compensation is already carried out on the transmit signals x_k prior to transmission.

IX. EVIDENCE APPENDIX

None.

X. RELATED PROCEEDINGS APPENDIX

None